

REMARKS/ARGUMENTS

Reconsideration of this application is requested. Claims 17-24 are active in the application subsequent to entry of this Amendment.

Claim 17 is amended in order to more particularly point out and distinctly claim that which applicants regard as their invention and to specify that the single-crystal GaN layer formed via a lateral-growth process defines the upper surface of the GaN substrate. Further, the small crack preventing layer is formed directly on the upper surface of the GaN substrate.

New claims 23 and 24 are added and directed to preferred aspects of the invention.

Claims 17 and 19-22 stand rejected as allegedly being obvious over Koide JP 11-145516 in view of Kern U.S. 6,194,742. Claim 18 is rejected as being "obvious" over the Koide reference. Applicants respectfully traverse these rejections.

The object of the present invention is to improve the lifetime of a nitride semiconductor laser and, more specifically, to solve two problems of a nitride semiconductor laser as explained below:

(1) First problem, which had been well known to those who skilled in the art, is the occurrence of "dislocations" in nitride semiconductor layers of the laser. In the present invention, this problem is solved by forming single-crystal GaN layer through a lateral-growth process (line 14 of page 5 – line 8 of page 6 of the specification). Koide discloses the use of a lateral growth technique to reduce dislocations (see abstract of Koide).

(2) Second problem, that the inventors recently found to be caused by employing the lateral growth process, is the occurrence of "small cracks". Surprisingly, the "small cracks" occur even without lattice mismatch or a difference in thermal expansion coefficient (see line 26 of page 4 to line 2 of page 5 of applicants' specification). This phenomena is apparently different from "dislocation" mentioned in Koide and normal "cracks", for example, mentioned in Kern. The present invention solves this strange

problem by forming a small-crack-preventing layer made of $\text{Al}_a\text{Ga}_{1-a}\text{N}$ ($0 < a < 0.1$) directly on the upper surface of the GaN substrate, i.e. directly on the laterally-grown single-crystal GaN layer of the GaN substrate and, thus, significantly improves the lifetime of a nitride semiconductor laser.

The examiner stated "Koide discloses a small crack-preventing layer 21 made of $\text{Al}_a\text{Ga}_{1-a}\text{N}$ ($0 < a < 0.15$) and contacting the substrate" (page 1, lines 17-18). Applicants disagree. While it is true Koide discloses a lateral growth process, Koide teaches nothing about the "small cracks" problem caused by the lateral growth process. Needless to say, Koide does not teach or suggest the small-crack preventing layer of the present invention.

Contrary to the examiner's suggestion, Koide's AlGaIn layer 21 is not a small-crack preventing layer formed directly on the laterally-grown GaN layer (= upper surface of said GaN substrate) but is merely an under layer of the laterally-grown GaN layer 3 (see Figure 2 of Koide). In other words, Koide's AlGaIn layer 21 is just a part of a GaN substrate. While Koide discloses forming a LED or laser structure on the laterally-grown GaN layer 3, Koide does not teach or suggest forming a small crack preventing layer made of $\text{Al}_a\text{Ga}_{1-a}\text{N}$ ($0 < a < 0.1$) directly on the GaN layer 3 before forming a double-hetero structure of the laser.


As for Kern, he merely discloses adding an interfacial layer to a laser or LED structure using conventional buffer technology (see abstract and figures of Kern). Kern does not teach or suggest employing a lateral growth technique and consequently teaches nothing about the "small cracks" problem caused by that technique. Also, Kern does not disclose forming a small-crack preventing layer made of $\text{Al}_a\text{Ga}_{1-a}\text{N}$ ($0 < a < 0.1$) directly on a laterally grown GaN layer.

For the above reasons it is respectfully submitted that claims 17-24 are in no way suggested by the applied references, considered individually or in combination. Reconsideration and favorable action are solicited.

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Respectfully submitted,

NIXON & VANDERHYE P.C.

By: 

Arthur R. Crawford
Reg. No. 25,327

ARC:eaw
1100 North Glebe Road, 8th Floor
Arlington, VA 22201-4714
Telephone: (703) 816-4000
Facsimile: (703) 816-4100